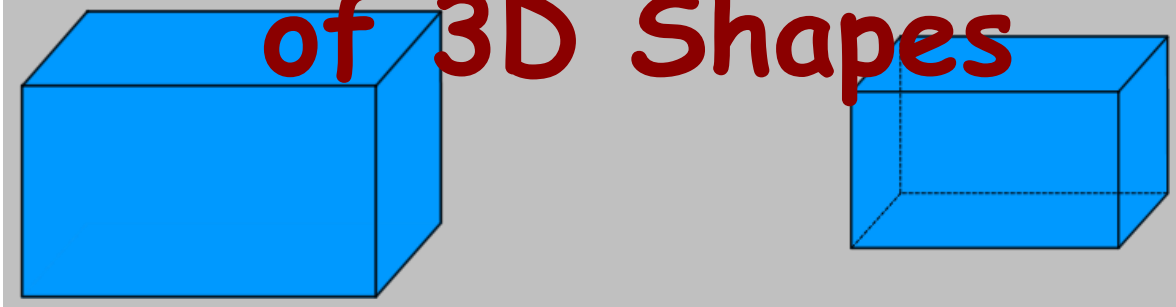
# Surface Area & Volume of 3D Shapes



Today:

- We are going to look over our volume and surface area formulas
- We are also going to do an example of a cone
- Then we are going to work on our flip charts!

## Project: Measurement Flip Chart

How to make your flip chart:
1. You need 3 sheets of paper
2. Lay the 3 sheets on top of one another and fold (watch demonstration)
3. Put 3 staples on the top (watch demonstration)

Your flip chart will contain the following:

Top Page: Title Page "Measurement Flip Chart"
Page 1: Perimeter/Area of a composite object
Page 2: Cone
Page 3: Rectangular Prism → $V = l \times w \times h$
Page 4: Rectangular Pyramid
Page 5: Sphere, Cylinder

- Your diagrams must be very neat (use ruler where necessary and draw pictures in pencil first!). Make sure to properly label your diagrams.
- Your writing must also be as neat as possible!
- There should be an example included for each object

Your flip chart will be marked as follows:

- Overall appearance/Effort/Neatness /10

- Page One:
  - -Diagram /2
  - -Formulas /3
  - -Example /3 /8

- Pages Two to Five:
  - -Diagrams (each worth two) /8
  - -Formulas (each worth one) /8
  - -Examples (each worth one) /8 /24

  (one diagram, surface area AND volume formula, and 2 examples per page!)

Total Value /42

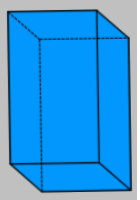
## Surface Area

When finding surface area of any 3D object, all you need to do is find the area of each face of the object and then add them all together!

When finding the surface area of an object, you can either use a model, sketch a diagram, or visualize the object. For all options, you will need to be able to calculate the answer.

**Definitions:**

1. "Faces" are the sides of the object.
   - for example, a rectangular prism, has 6 faces.
     -3 pairs of rectangles



2. A Composite Object is an object composed of 2 or more objects.

# Area Formulas

To find area:

Area of a rectangle = length x width (l x w)

Area of a triangle = $\frac{\text{base x height}}{2}$

Area of a circle = $\pi r^2$

# LETS REVIEW Perimeter and Area

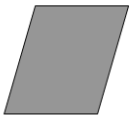
Perimeter of a Square $P = 4s$

Area of a Square $A = s^2$

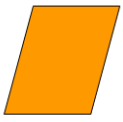
Perimeter of a Rectangle $P = 2L + 2W$

Area of a Rectangle $A = LW$ or $Bh$

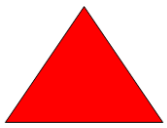
# LETS REVIEW



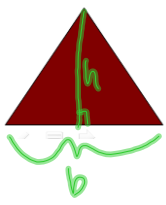
Perimeter of a Parallelogram $P = 2b + 2s$



Area of a Parallelogram $A = bh$



Perimeter of a Triangle $P = s + s + s$

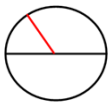



Area of a Triangle $A = \frac{bh}{2}$

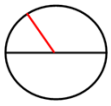
# LETS REVIEW

**Perimeter of a Trapezoid** $P = s + s + s + s$

**Area of a Trapezoid** $A = \frac{h(a+b)}{2}$



**Circumference of a Circle** $C = \pi d$ or $C = 2\pi r$

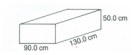
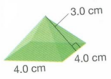


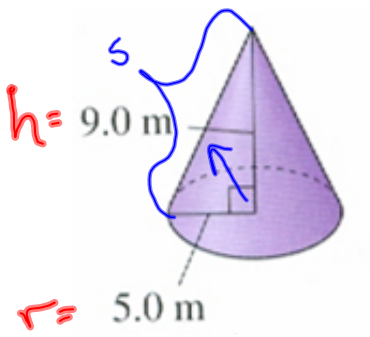
**Area of a Circle** $A = \pi r^2$

$\pi = 3.14$

$r = \frac{d}{2}$

# LETS REVIEW Surface Area

| | |
|---|---|
|  **Surface area of Rectangular Prism** | **Total Surface Area** $V = lwh$ **= 2(top and Bottom) + 2(Ends) + 2(Front and Back)** |
|  **Surface Area of a Triangular Prism** | **Total Surface Area = Bottom + 2(Ends) + Front + Back** |
|  **Surface Area of a Pyramid** | **Total Surface Area = Bottom + 4(sides)** |
|  **Surface Area of a Cone** | **Total Surface Area = Circle + curved surface = $\pi r^2$ + $\pi r s$** |

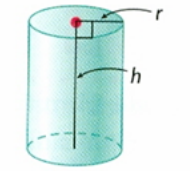



$c^2 = a^2 + b^2$
$= 5^2 + 9^2$
$= 25 + 81$
$= \sqrt{106}$
$= 10.3\text{m}$

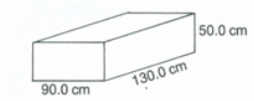
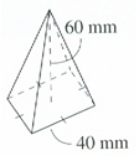
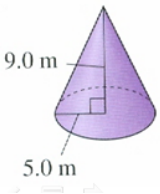
$SA = \pi r^2 + \pi rs$
$= (3.14)(5)^2 + (3.14)(5)(10.3)$
$= 78.5 + 161.71$
$= 240.2\text{m}^2$

$V = \frac{\pi r^2 h}{3} = \frac{(3.14)(5)^2(9)}{3}$
$= 235.5\text{m}^3$

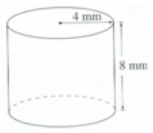
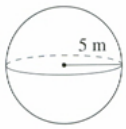
# LETS REVIEW

| | |
|---|---|
|   **Surface area of Cylinder** | **Total Surface Area**<br>**= 2(circles) + curved surface**<br>**= 2(** $\pi r^2$ **) +** $\pi dh$ |
| | |

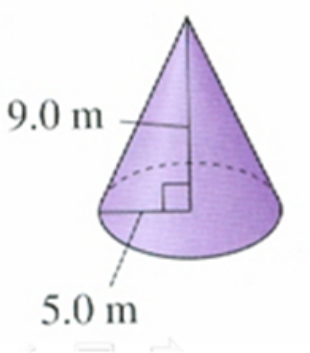
# LETS REVIEW Volume

| | |
|---|---|
|  Volume of Rectangular Prism | V = Area of base x height<br>V = lwh |
|  Volume of a Triangular Prism | V = Area of base x height<br>$V = \frac{bh}{2}(h)$ |
|  Volume of a Pyramid | $V = \frac{1}{3}$ Area of base x height |
|  Volume of a Cone | $V = \frac{1}{3}$ Volume of cylinder<br>$V = \frac{1}{3}\pi r^2 h$ |

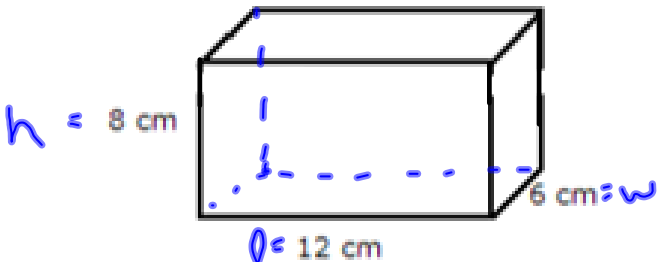
# LETS REVIEW

| | |
|---|---|
|  Volume of Cylinder | V = Area of base x height<br>$V = \pi r^2 h$ |
|  Volume of a Sphere | $V = \frac{4}{3}\pi r^3$ |
| | |

## Practice




## Practice




area = _____ $cm^2$

$V = l \cdot w \cdot h$

=

SA

Bottom + Top

$l \times w \times 2$

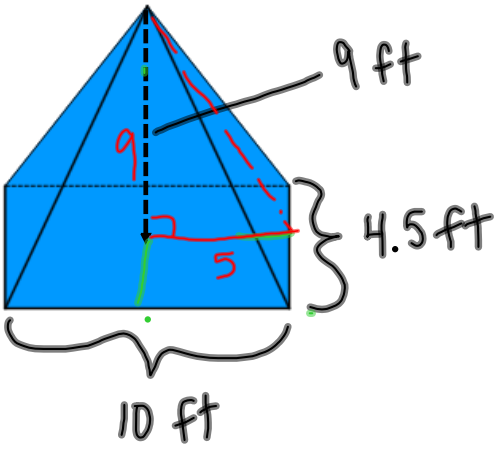
$12 \times 6 \times 2$

=

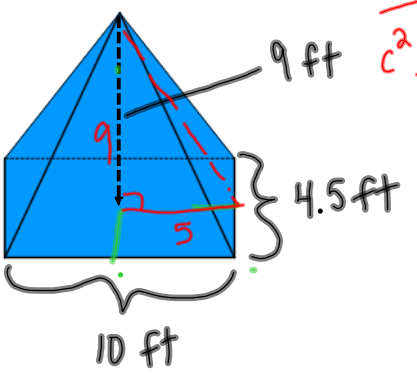
ends

Front + Back

## Practice




## Practice




$V = lwh$

$V = (10)(4.5)(9)$

$= 405 \text{ ft}^3$

$\frac{}{3}$

$= 135 \text{ ft}^3$

sides $A = \frac{b \times h}{2} = \frac{(4.5)(10.3)}{2} = 23.2 \times 2 = 46.4 \text{ ft}^2$

$c^2 = a^2 + b^2$

$= 9^2 + 5^2$

$= 81 + 25 = \sqrt{106} = 10.3 \text{ ft}$

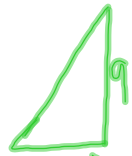
S.A. =

TOTAL $= 184.4 \text{ ft}^2$

Bottom $A = l \times w$

$= 10 \times 4.5$

$= 45 \text{ ft}^2$




Front + Back

$A = \frac{b \times h}{2} = \frac{10 \times (9.3)}{2}$

$= 46.5$

$\times 2$

$= 93 \text{ ft}^2$

$c^2 = a^2 + b^2$

$= (2.25)^2 + (9)^2$

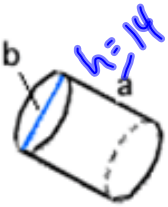
$= 5.1 + 81$

$= \sqrt{86.1}$

height $= 9.3 \text{ ft}$

## Practice

d = 10.2




a = 14 in

b = 10.2 in

$V = \pi r^2 h$

$= (3.14)(5.1)^2(14)$

$= 1143.4 \text{ in}^3$

$S.A. = 2\pi r^2 + 2\pi rh$

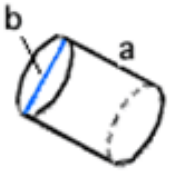
(circles) (rectangle)

$= 2(3.14)(5.1)^2 + 2(3.14)(5.1)(14)$

$= 163.3 + 448.4$

$= 611.7 \text{ in}^2$

## Practice




a = 14 in

b = 10.2 in

÷2

r = 5.1

$V = \pi r^2 h$

$= (3.14)(5.1)^2(14)$

$= 1143.4 \text{ in}^3$

$SA = 2\pi r^2 + 2\pi rh$

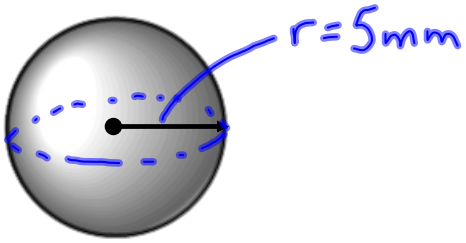
(circles) (rectangle)

$= 2(3.14)(5.1)^2 + 2(3.14)(5.1)(14)$

$= 163.3 + 448.4$

$= 611.7 \text{ in}^2$

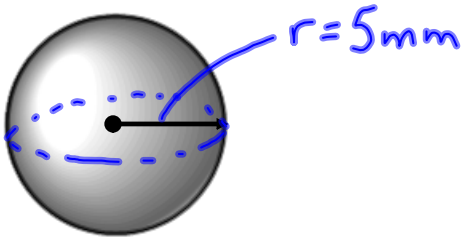
## Practice




$$V = \frac{4\pi r^3}{3} = \frac{4(3.14)(5)^3}{3} = \frac{1570}{3} = 523.3\ mm^3$$

$$S.A. = 4\pi r^2 = 4(3.14)(5)^2 = 314\ mm^2$$

## Practice




$$V = \frac{4\pi r^3}{3} = \frac{4(3.14)(5)^3}{3} = \frac{1570}{3} = 523.3\ mm^3$$

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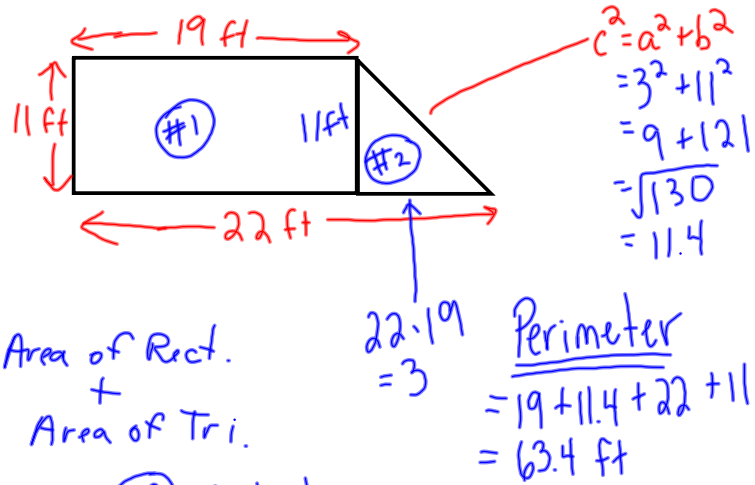



## Surface area and Volume formulas

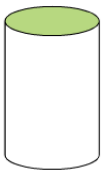
Surface area $= \frac{1}{2}s$(perimeter of base) + (base area)

$V = \frac{1}{3}lwh$

Pyramid

SA = $2\pi r^2 + 2\pi rh$

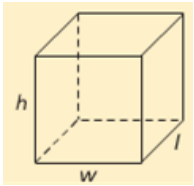
$V = \pi r^2 h$



Cylinder

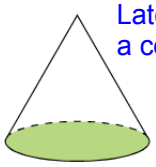
**SA = 2lh + 2lw = 2wh**

**V = lwh**




SA = $\pi rs + \pi r^2$

V = 1/3 $\pi r^2 h$



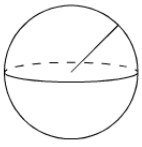
Cone

Lateral Area of a cone:

$A_L = \pi rs$

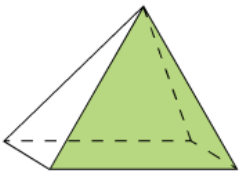
SA = $4\pi r^2$

$V = \frac{4}{3}\pi r^3$



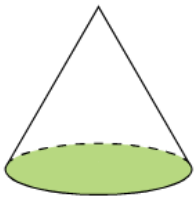
Sphere

l = 10.0'
w = 6.0'
h = 11.0'
s = ?



Pyramid

r = 4.0 m
h = 12.0 m
s = 11.3 m

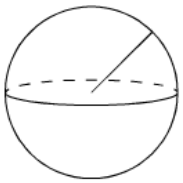


Cone

r = 6"
h = 20"

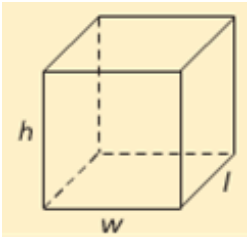
Cylinder

r = 10 cm



Sphere

h = 4 yd
w = 3 yd
l = 3 yd

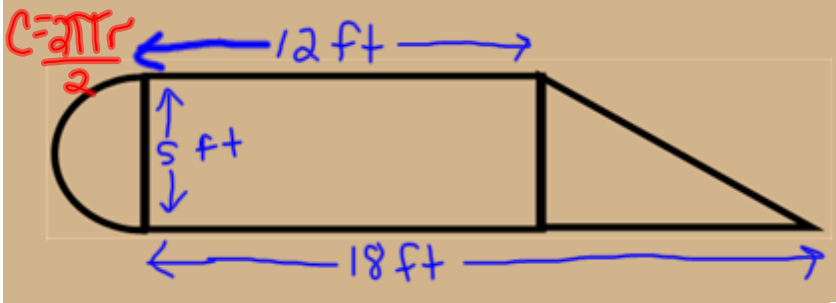



# Pop Quiz

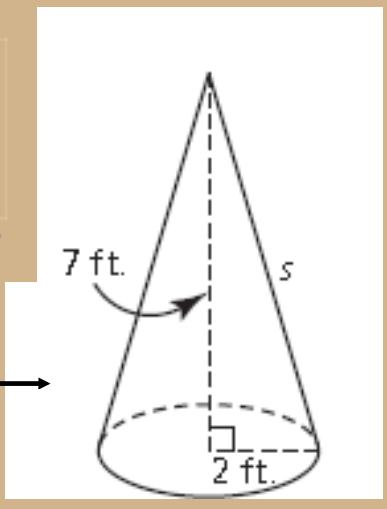
#1 Convert the following:

a. 12 km into mm
b. 26 in into ft with in
c. 0.34 cm into hm
d. 8.5 yards into m
e. 348 miles into km

#2 Find the Perimeter and Area




#3 Find the Volume and Surface Area



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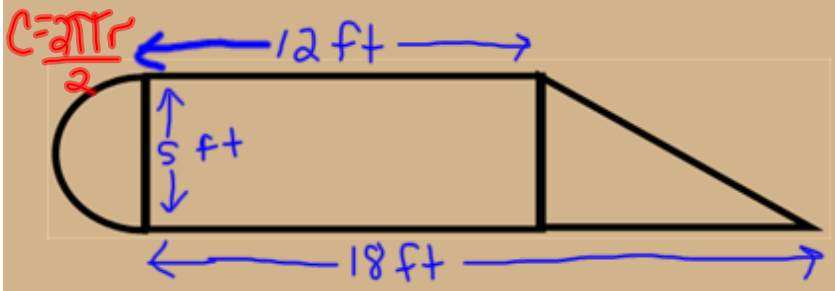
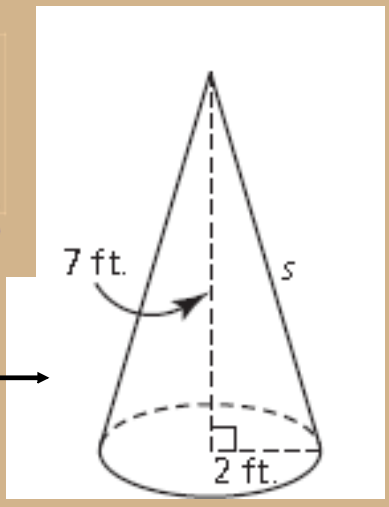



#3 Find the Volume and Surface Area




We are going to go over the answers to the pop quiz that we had Tuesday. Hi Ll From: Shawn D

#1 Convert the following:

a. 12 km into mm
b. 26 in into ft with in
c. 0.34 cm into hm
d. 8.5 yards into m
e. 348 miles into km

a) 12 km = 12000000 mm

b) 2 ft 2 in

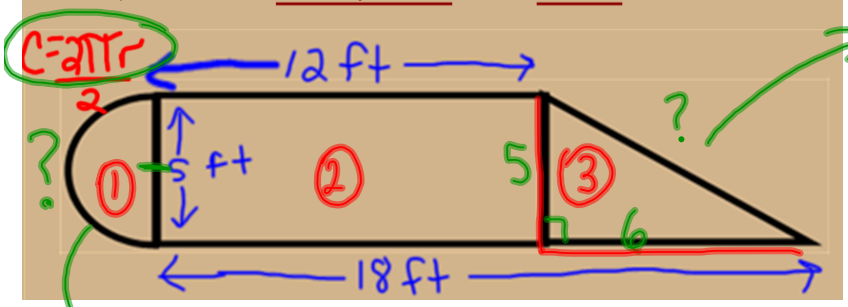
c) 0.000034 hm

d) $8.5\text{ yds} \times \frac{0.9144\text{ m}}{1\text{ yd}} = 7.77\text{ m}$

e) $348\text{ mi} \times \frac{1.6093\text{ km}}{1\text{ mi}}$

560 km

## #2 Find the Perimeter and Area




$C = \frac{2\pi r}{2}$

$= \frac{2(3.14)(2.5)}{2}$

$= 7.9$ ft

$c^2 = a^2 + b^2$

$= 5^2 + 6^2$

$= 25 + 36$

$= \sqrt{61}$

$= 7.8$ ft

$P = 12 + 7.8 + 18 + 7.9 = 45.7$ ft

① $A = \frac{\pi r^2}{2}$

$= \frac{(3.14)(2.5)^2}{2}$

$= 9.8\ ft^2$

② $A = lxw$

$= 12 \times 5$

$= 60\ ft^2$

③ $A = \frac{bxh}{2} = \frac{6 \times 5}{2}$

$= 15\ ft^2$

Total $= 84.8\ ft^2$

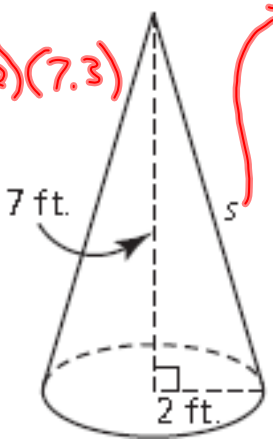
## #3 Find the Volume and Surface Area

$SA = \pi r^2 + \pi r s$

$= (3.14)(2)^2 + (3.14)(2)(7.3)$

$= 12.56 + 45.84$

$= 58.4\ ft^2$




$c^2 = a^2 + b^2$

$= 7^2 + 2^2$

$= 49 + 4$

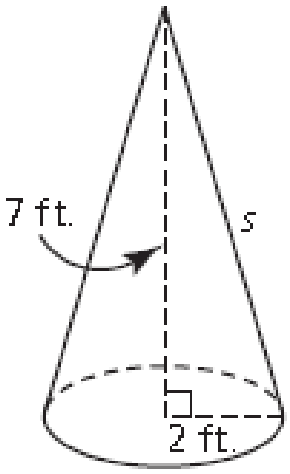
$= \sqrt{53} = 7.3$ ft

$V = \frac{\pi r^2 h}{3}$

$= \frac{(3.14)(2)^2(7)}{3}$

$= 29.3\ ft^3$

## Example 3 Determining the Surface Area of a Right Cone



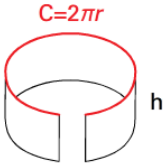

$$SA = \pi rs + \pi r^2$$

## Cylinders

***Example 1***

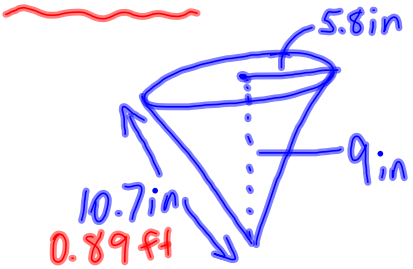
A cannery has redesigned the size of the can for its canned herring. The diameter of the new can is 4″ and its height is 5.5″. How much tin will be needed to construct one can?


$SA = 2\pi r^2 + 2\pi rh$
$= 2(3.14)(2)^2 + 2(3.14)(2)(5.5)$
$= 25.12 + 69.08$
$= 94.2\ in^2$



# Practice Questions:

1. Jennifer must make a conical funnel out of sheet metal. If the funnel is 9 inches tall, has a slant height of 10.7 inches, and has a radius of 5.8 inches at the top, what is the surface area of the sheet metal in square feet?




CONE

$SA = \cancel{\pi r^2}\ (\text{circle}) + \pi r s\ (\text{side})$

Not covered

$SA = (3.14)(0.48)(0.89)$

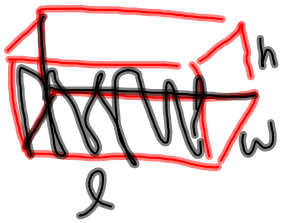
$= 1.34\ ft^2$

$10.7\ in \times \frac{1\ ft}{12\ in} = 0.89\ ft$

$9\ in \times \frac{1\ ft}{12\ in} = 0.75\ ft$

$5.8\ in \times \frac{1\ ft}{12\ in} = 0.48\ ft$

2. Genevieve plans to apply two coats of paint to the walls of her garden shed. The shed is 8 feet long by 6 feet wide by 7 feet tall. If there are 3 windows that are 2 feet by 18 inches each, what will be the total area she paints?




$l = 8\ ft$

$w = 6\ ft$

$h = 7\ ft$

$A = l \times h$

$= 8 \times 7$

$= 56\ ft^2$

$\times 2$

$= 112\ ft^2$

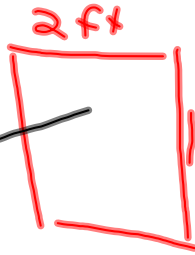
$A = w \times h$

$= 6 \times 7$

$= 42$

$\times 2$

$= 84\ ft^2$




$A = l \times w$

$= 2 \times 1.5$

$= 3\ ft^2$

$\times 3$

$= 9\ ft^2$

$18\ in \div 12 = 1.5\ ft$

$total =$

$112 + 84 - 9$

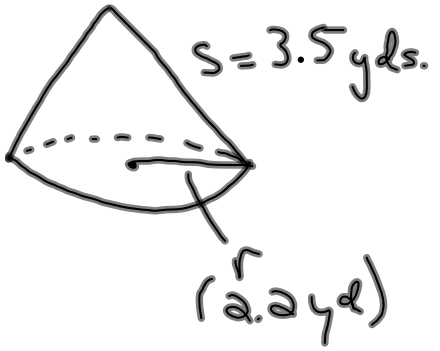
$= 187\ ft^2$

$\times 2$

$= 374\ ft^2$

3. Sheet metal costs $54.25/yd$^2$. How much will it cost Hamish to cover a conical roof if it has a radius of 2.2 yards and a slant height of 3.5 yards?

CONE




$SA = \pi r^2 + \pi r s$

$= (3.14)(2.2)(3.5)$

$= 24.2 \text{ yd}^2$

$\times \$54.25$

$\$1312.85$

4. A fish tank is a rectangular prism that is 30 inches long, 24 inches deep, and 18 inches high. How much water will it hold:

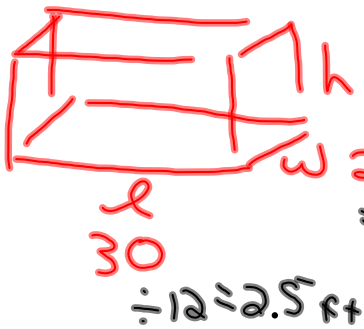
a) in cubic inches?

b) in cubic feet?

a) $V = l \times w \times h$

$= 30 \times 24 \times 18$

$= 12960 \text{ in}^3$




b) $V = l \times w \times h$

$= 2.5 \times 2 \times 1.5$

$= 7.5 \text{ ft}^3$

5. Will the contents of a box that is 3 inches by 4 inches by 6 inches fit into a cube with sides of 4 inches?

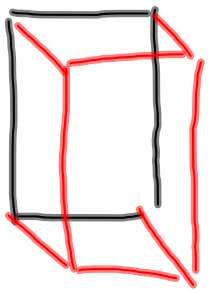
$V = l \times w \times h$
$= 3 \times 4 \times 6$
$= 72\ in^3$

$V = l \times w \times h$
$= 4 \times 4 \times 4$
$= 64\ in^3$

NO

Hi/Bye
Mrs. Belyea

6. A driveway is 36 ft long and 10 ft wide, and will be covered in gravel that is 2 in deep. How many cubic yards of gravel will be needed?



$l = 36\ ft \div 3 = 12\ yd$
$w = 10\ ft \div 3 = 3.3\ yd$
$h = 2\ in \div 12 \div 3 = 0.05\ yd$

$V = l \times w \times h$
$= 12 \times 3.3 \times 0.05$
$= 1.98\ yd^3$

238 hm → cm

2380000 cm

60 L → mL

60000 mL

0.58 dm → km

0.0000058 km

5689 cg → dag

5.689 dag

26.3 yd = ? m

$26.3\ \text{yd} \times \frac{0.9144\ \text{m}}{1\ \text{yd}} =$ m

## Attachments

geometry review.ppt